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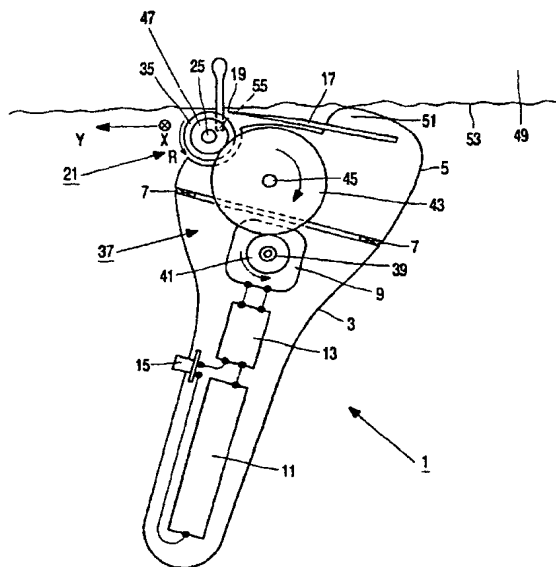
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[Continued on next page]

(54) Title: SHAVING HEAD WITH ROTATABLE HAIR MANIPULATOR



(57) Abstract: The invention relates to a shaving head (5) which comprises a cutting member (17) having a cutting edge (19) for cutting hairs (55) growing from human skin (49). The shaving head (5) also comprises a hair manipulator (21) which is arranged in front of the cutting edge, viewed in a shaving direction (Y) of the shaving head. The hair manipulator can be rotated about an axis of rotation (23) extending substantially parallel to the cutting edge, to move the hairs in a direction (X) which is substantially parallel to the cutting edge. According to the invention, the hair manipulator is drivable in a direction of rotation R in which the hair manipulator moves away from the cutting edge in positions where the hair manipulator is in contact with the skin. In this manner, the rotating hair manipulator smoothes the skin in front of the cutting edge, so that folds of the skin in front of the cutting edge, causing incised wounds and skin irritations, are precluded as much as possible. In this manner, the hair manipulator effectively protects the skin against

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such wounds and irritations. In a preferred embodiment, the hair manipulator comprises a plurality of disc-shaped elements (35), which are mounted on a rotatable shaft (25) at regular mutual intervals (G) and which are arranged obliquely with respect to the axis of rotation.

Shaving head with rotatable hair manipulator.

The invention relates to a shaving head comprising a cutting member having a cutting edge for cutting hairs growing from skin and a hair manipulator which is arranged, viewed in a displacement direction of the shaving head, in front of the cutting edge and which can be rotated about an axis of rotation extending substantially parallel to the cutting edge to move the hairs in a direction substantially parallel to the cutting edge.

A shaving head of the type mentioned in the opening paragraph is known from US Patent 2,568,047. The known shaving head is detachably secured to a holder provided with a handle. The cutting member is arranged in a fixed position in the shaving head. The hair manipulator comprises a circularly cylindrical guide roller extending substantially parallel to the cutting edge. Said guide roller comprises two contiguous series of semi-annular grooves which are mutually arranged so as to form a V, said semi-annular grooves being obliquely arranged with respect to the axis of rotation, and one of the grooves being in engagement with a cam which is arranged in a fixed position with respect to the cutting member. When a user moves the shaving head over the skin in the displacement direction, the guide roller is rotated about the axis of rotation as a result of contact with the skin. The engagement of said cam with one of the grooves in combination with the rotation of the guide roller leads to reciprocating movements of the guide roller with respect to the cutting member in a direction substantially parallel to the cutting edge. As a result, the skin which is present in front of the cutting edge and which is in contact with the guide roller is reciprocated in a direction substantially parallel to the cutting edge, causing the hairs present on the skin in front of the cutting edge to be reciprocated along the cutting edge during the cutting operation. As a result, a cutting force necessary in the displacement direction to cut the hairs is limited substantially, resulting in a substantial improvement of the shaving performance and the shaving comfort of the shaving head.

A drawback of the known shaving head resides in that during the displacement of the shaving head over the skin, a skin crease may readily be formed between the rotating

hair manipulator and the cutting edge, which may lead to skin irritations or even incised wounds.

It is an object of the invention to provide a shaving head of the type mentioned in the opening paragraph, which also enables the necessary cutting forces in the displacement direction to be limited, while, in addition, the above-mentioned drawback of the known shaving head is precluded as much as possible.

To achieve this object, a shaving head in accordance with the invention is characterized in that the hair manipulator is drivable in a direction of rotation in which the hair manipulator moves away from the cutting edge at locations where the hair manipulator is in contact with the skin. By driving the hair manipulator, in operation, in said direction of rotation, the hair manipulator smoothes the skin directly in front of the cutting edge in a direction away from the cutting edge, so that skin creases in front of the cutting edge are precluded as much as possible. By embodying the hair manipulator so as to be suitable for this purpose, in operation, the rotation of the hair manipulator in said direction of rotation leads to the generation of reciprocating movements of the hairs present in front of the cutting edge in a direction substantially parallel to said cutting edge, as in the known shaver, resulting in a limitation of the cutting forces necessary in the displacement direction.

A particular embodiment of a shaving head in accordance with the invention is characterized in that the hair manipulator is arranged in a substantially fixed position with respect to the cutting member, viewed in a direction parallel to the cutting edge, and provided with a circularly cylindrical surface having a series of annular grooves which are obliquely arranged with respect to the axis of rotation. In this manner, a simple and efficacious construction of the hair manipulator is obtained. As said grooves are obliquely arranged with respect to the axis of rotation, reciprocating movements of the grooves with respect to the cutting edge occur near the cutting edge in a direction substantially parallel to said cutting edge during the rotation of the hair manipulator. When a user moves the shaving head over the skin in the displacement direction, the hairs are first caught in said grooves. By providing the grooves with a suitable width and a suitable mutual interspace for this purpose, reciprocating movements of the hairs caught in the grooves in a direction substantially parallel to the cutting edge are generated by means of the hair manipulator, so that the hairs are reciprocated along the cutting edge during the cutting operation and the cutting forces are reduced.

A further embodiment of a shaving head in accordance with the invention is characterized in that the hair manipulator is arranged in a substantially fixed position with

respect to the cutting member, viewed in a direction parallel to the cutting edge, and provided with a series of disc-shaped elements which are obliquely arranged with respect to the axis of rotation and provided with mutual interspaces. In this manner, also a simple and efficacious construction of the hair manipulator is obtained. As the disc-shaped elements are obliquely  
5 arranged with respect to the axis of rotation, reciprocating displacements of the interspaces between the discs occur near the cutting edge, during rotation of the hair manipulator, said displacements taking place with respect to the cutting edge in a direction substantially parallel to the cutting edge. When a user moves the shaving head over the skin in the displacement direction, the hairs are first caught in said interspaces. By providing the disc-  
10 shaped elements with suitable dimensions and suitable mutual interspaces, reciprocating displacements of the hairs caught in the interspaces in a direction substantially parallel to the cutting edge are generated by means of the hair manipulator, so that the hairs are reciprocated along the cutting edge during the cutting operation and the cutting forces are reduced.

A shaver in accordance with the invention is provided with a shaving head in  
15 accordance with the invention and a drive mechanism for driving the hair manipulator in said direction of rotation. The shaving head is, for example, detachably secured to a housing or a holder of the shaver wherein the drive mechanism is arranged, so that the shaving head can be exchanged if the cutting member has become blunt.

20 These and other aspects of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter.

In the drawings:

Fig. 1 diagrammatically shows an embodiment of a shaver in accordance with  
25 the invention, which is provided with a shaving head in accordance with the invention, and

Fig. 2 is a diagrammatic front view of the shaving head used in the shaver shown in Fig. 1.

30 Fig. 1 shows an embodiment of a shaver 1 in accordance with the invention, which shaver comprises a housing 3 on which a shaving head 5 in accordance with the invention is detachably secured by means of securing means 7 which, for the sake of simplicity, are only diagrammatically shown in the Figure and may be of a customary type which is known per se. The housing 3 accommodates an electric motor 9, a battery 11 for

feeding the motor 9, and an electric control element 13 for controlling the motor 9. The motor 9 can be switched on and off by means of a switch 15 provided on the housing 3.

As shown in Figs. 1 and 2, the shaving head 5 is provided with a cutting member 17 which is arranged in a fixed position in the shaving head 5. In the embodiment shown, the cutting member 17 is plate-shaped and provided with a straight cutting edge 19 for cutting hairs growing from skin. The cutting edge 19 extends parallel to an X-direction which is perpendicular to a displacement direction or shaving direction Y of the shaving head 5. The shaving head 5 further comprises a hair manipulator 21 which, viewed in the displacement direction Y, is arranged in front of the cutting edge 19 and can be rotated about an axis of rotation 23 which extends substantially parallel to the cutting edge 19. In the embodiment shown, the hair manipulator 21 comprises a shaft 25 which is mounted in the shaving head 5 by means of two bearing bushes 27 and 29 so as to be rotatable about the axis of rotation 23. Viewed in a direction parallel to the X-direction, the shaft 25 is confined between two closing elements 31 and 33, so that the hair manipulator 21 is arranged in a substantially fixed position with respect to the shaving head 5 and the cutting member 17, viewed in a direction parallel to the cutting edge 19. In the embodiment shown, the hair manipulator 21 further comprises a series of disc-shaped elements 35 which are arranged on the shaft 25 at regular distances G with respect to each other and are obliquely arranged with respect to the axis of rotation 23. It is to be noted that the disc-shaped elements 35 are provided substantially throughout the length of the cutting edge 19 but, for the sake of simplicity, only a few disc-shaped elements 35 are shown in Fig. 2. The hair manipulator 21 is drivable about the axis of rotation 23 by means of a drive mechanism 37 of the shaver 1, which comprises the above-mentioned motor 9. The drive mechanism 37 further comprises an outgoing shaft 39 of the motor 9 extending substantially parallel to the X-direction, a first friction wheel 41 which is secured to the outgoing shaft 39, a second friction wheel 43 which is mounted in the shaving head 5 so as to be rotatable about a shaft 45 extending parallel to the X-direction, and a third friction wheel 47 which is provided on the shaft 25 of the hair manipulator 21 and is in contact with the second friction wheel 43. In the situation shown in Fig. 1, wherein the shaving head 5 is secured on the housing 3, the second friction wheel 43 is in contact with the first friction wheel 41, so that the hair manipulator 21 is drivable by the motor 9, while the second friction wheel 43 is released from the first friction wheel 41 when the shaving head 5 is detached from the housing 3.

As shown in Fig. 1, in operation, the shaving head 5 is in contact with skin 49 to be treated via the disc-shaped elements 35 of the hair manipulator 21 and via a supporting

element 51 of the shaving head 5, the cutting edge 19 of the cutting member 17 being situated substantially at a surface 53 of the skin 49. As shown in Fig. 1, in operation, the hair manipulator 21 is driven by the drive mechanism 37 in a direction of rotation R, causing the disc-shaped elements 35 of the hair manipulator 21 to move away from the cutting edge 19 at locations where the disc-shaped elements 35 are in contact with the skin 49. In this manner, it is achieved that the skin directly in front of the cutting edge 19 is smoothed in a direction away from the cutting edge 19 under the influence of friction forces exerted on the skin 49 by the rotating disc-shaped elements 35. As a result, skin creases in front of the cutting edge 19 and the associated skin irritations and incised wounds are precluded as much as possible, so that the hair manipulator 21 provides a reliable protection against such skin irritations and incised wounds.

In addition, by using the hair manipulator 21, a limitation of the cutting forces is achieved which, viewed parallel to the displacement direction Y of the shaving head 5, are necessary to cut the hairs. Figs. 1 and 2 show a hair 55 to be cut. When a user moves the shaving head 5 over the skin 49 in the displacement direction Y, the hair 55 is first caught between the rotating disc-shaped elements 35 of the hair manipulator 21. As shown in Fig. 2, a diameter  $D_1$  of the disc-shaped elements 35 is so much larger than a diameter  $D_2$  of the shaft 25 that the hair 55 can travel past the shaft 25 and penetrate as far as the cutting edge 19. In the embodiment shown, the diameter  $D_1$  is approximately 1 mm and the diameter  $D_2$  is approximately 0.4 mm, so that hairs, which have an average growing period of 1 to 2 days, can easily penetrate as far as the cutting edge 19. As the disc-shaped elements 35 are obliquely arranged with respect to the axis of rotation 23, and the hair manipulator 21 is arranged in a fixed position with respect to the cutting member 17, viewed in a direction parallel to the X direction, rotation of the hair manipulator 21 causes, near the cutting edge 19, reciprocating movements of the disc-shaped elements 35 with respect to the cutting edge 19 in a direction parallel to the cutting edge 19. Since the distance G between the disc-shaped elements 35 is of an order of magnitude which corresponds to an order of magnitude of an average hair diameter, also the hair 55 present between the rotating disc-shaped elements 35 is reciprocated by the disc-shaped elements 35 in a direction substantially parallel to the cutting edge 19. As a result, the hair 55 is reciprocated along the cutting edge 19 during the cutting operation, causing the cutting force necessary in the displacement direction Y to cut the hair 55 to be limited substantially. As a result, not only the shaving performance but also the shaving comfort of the shaver 1 is improved considerably. In the embodiment shown, the distance G between the disc-shaped elements 35 and a width W of the disc-shaped elements

35 are both approximately 0.3 mm, while the disc-shaped elements 35 include an angle  $\alpha$  of approximately  $60^\circ$  with the axis of rotation 23. Satisfactory results are obtained if the distance G between the disc-shaped elements 35 ranges between approximately 0.1 mm and 0.4 mm and if the rotation frequency of the hair manipulator 21 is approximately 100 Hz or higher.

The disc-shaped elements 35 of the hair manipulator 21 are, for example, made from a synthetic resin or a hard type of rubber, so that a high frictional force between the rotating disc-shaped elements 35 and the skin 49 is obtained. The shaft 25 of the hair manipulator is, for example, manufactured from a type of steel, and the disc-shaped elements are, for example, shrunk onto the shaft 25. The shaft 25 and the disc-shaped elements 35 may alternatively be manufactured as a single integrated part of synthetic resin by means of, for example, an injection molding process. A hair manipulator 21' of an alternative embodiment of a shaving head 5' in accordance with the invention may also be manufactured by means of such an injection molding process. The hair manipulator 21' of the shaving head 5' is also shown in Fig. 2 and comprises a rod-shaped body having a circularly cylindrical surface 57'. The hair manipulator 21' is provided with a series of ring-shaped grooves 59' which are spaced at regular intervals G' in the surface 57' and are obliquely arranged with respect to the axis of rotation 23. The grooves 59' are provided substantially throughout the length of the cutting edge 19, but in Fig. 2 only a few grooves 59' are shown for the sake of simplicity. The depth of the grooves 59' approximately corresponds to half a difference between the diameters  $D_1$  and  $D_2$  in the case of the hair manipulator 21, and the width W' of said grooves approximately corresponds to the distance G in the case of the hair manipulator 21, while the distance G', in the case of the hair manipulator 21', approximately corresponds to the width W in the case of the hair manipulator 21. The operation of the hair manipulator 21' substantially corresponds to that of the hair manipulator 21.



## CLAIMS:

1. A shaving head comprising a cutting member having a cutting edge for cutting hairs growing from skin and a hair manipulator which is arranged, viewed in a displacement direction of the shaving head, in front of the cutting edge and which can be rotated about an axis of rotation extending substantially parallel to the cutting edge to move the hairs in a direction substantially parallel to the cutting edge, characterized in that the hair manipulator is drivable in a direction of rotation in which the hair manipulator moves away from the cutting edge at locations where the hair manipulator is in contact with the skin.

2. A shaving head as claimed in claim 1, characterized in that the hair manipulator is arranged in a substantially fixed position with respect to the cutting member, viewed in a direction parallel to the cutting edge, and provided with a circularly cylindrical surface having a series of annular grooves which are arranged obliquely with respect to the axis of rotation.

3. A shaving head as claimed in claim 1, characterized in that the hair manipulator is arranged in a substantially fixed position with respect to the cutting member, viewed in a direction parallel to the cutting edge, and provided with a series of disc-shaped elements which are obliquely arranged with respect to the axis of rotation and provided with mutual interspaces.

4. A shaver comprising a shaving head as claimed in claim 1, 2 or 3, and a drive mechanism for driving the hair manipulator in the above-mentioned direction of rotation.

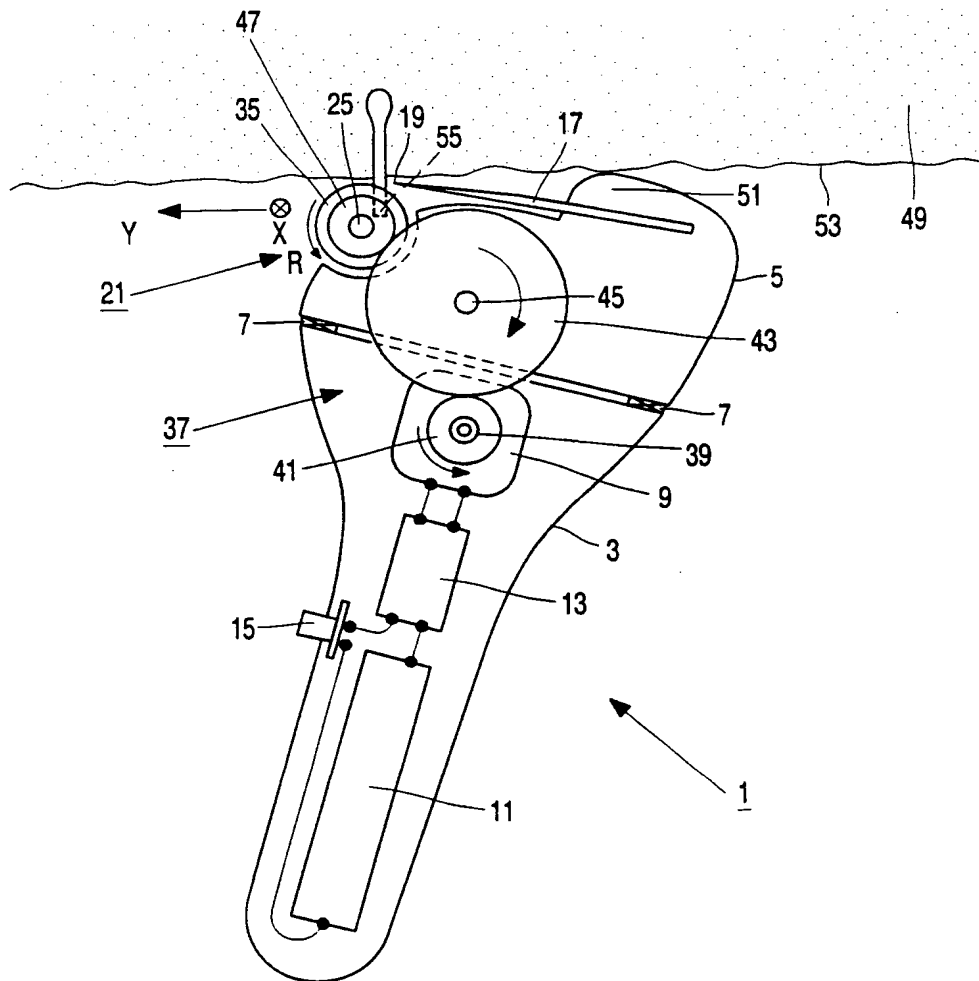
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FIG. 2

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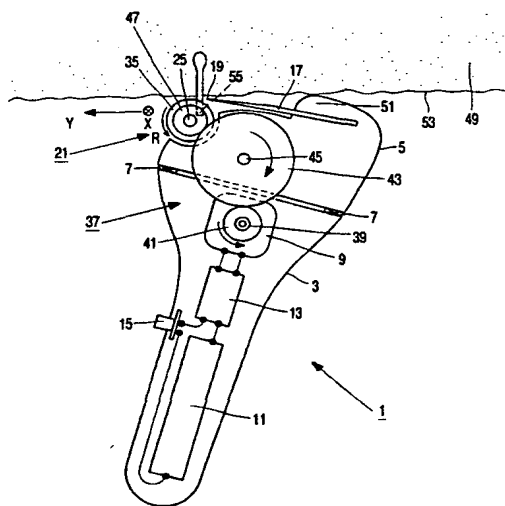
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(54) Title: **SHAVING HEAD WITH ROTATABLE HAIR MANIPULATOR**



(57) Abstract: The invention relates to a shaving head (5) which comprises a cutting member (17) having a cutting edge (19) for cutting hairs (55) growing from human skin (49). The shaving head (5) also comprises a hair manipulator (21) which is arranged in front of the cutting edge, viewed in a shaving direction (Y) of the shaving head. The hair manipulator can be rotated about an axis of rotation (23) extending substantially parallel to the cutting edge, to move the hairs in a direction (X) which is substantially parallel to the cutting edge. According to the invention, the hair manipulator is drivable in a direction of rotation R in which the hair manipulator moves away from the cutting edge in positions where the hair manipulator is in contact with the skin. In this manner, the rotating hair manipulator smoothes the skin in front of the cutting edge, so that folds of the skin in front of the cutting edge, causing incised wounds and skin irritations, are precluded as much as possible. In this manner, the hair manipulator effectively protects the skin against such wounds and irritations. In a preferred embodiment, the hair manipulator comprises a plurality of disc-shaped elements (35), which are mounted on a rotatable shaft (25) at regular mutual intervals (G) and which are arranged obliquely with respect to the axis of rotation.

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# INTERNATIONAL SEARCH REPORT

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**A. CLASSIFICATION OF SUBJECT MATTER**  
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**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

WPI Data, EPO-Internal, PAJ

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category * | Citation of document, with indication, where appropriate, of the relevant passages                                    | Relevant to claim No. |
|------------|---|-----------------------|
| A          | US 2 568 047 A (ANDERSON)<br>18 September 1951 (1951-09-18)<br>cited in the application<br>the whole document<br>---- | 1                     |
| A          | CH 355 713 A (MILLER HERMANN)<br>15 July 1961 (1961-07-15)<br>the whole document<br>----                              | 1                     |
| A          | US 2 766 521 A (BENVENUTTI)<br>16 October 1956 (1956-10-16)<br>the whole document<br>-----                            | 1                     |



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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Information on patent family members

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|---|---------------------|----------------------------|---------------------|
| US 2568047                                | A                   | 18-09-1951                 | NONE                |
| CH 355713                                 | A                   | 15-07-1961                 | NONE                |
| US 2766521                                | A                   | 16-10-1956                 | NONE                |